



Materials Engineering Branch

TIP*



No. 030 Shelf Life of Organic Materials

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Many materials that are used in space flight hardware are organic in nature and have a limited shelf or storage life. Polymeric resins, catalysts, some liquid lubricants and polymeric films (such as adhesive films) will tend to change slowly over time, even in sealed containers. In most cases, the manufacturer specifies the shelf life on the package but frequently no mention is made of the storage temperature. Almost always, the lower the storage temperature of an organic material, its shelf life is longer.

Another factor that influences the shelf life is the length of time that the product has been exposed to air or its constituents such as oxygen, moisture, ozone, or other active agents. Usually, the more exposure there is to air, the shorter the shelf life. Although changes in packaged products may not be easily discernible as they age, except for viscosity changes, they will become evident as the polymeric materials are cured. In some cases, the mechanical or physical properties are degraded. In other cases, completely cured products do not develop at all. Films may become embrittled or lose strength. Lubricants may precipitate additives or separate into multiple phases.

Because of energy conservation measures, in many plants, air conditioning systems are shut down at night and over weekends with the result that normally acceptable storage temperatures may increase significantly during these periods. Such higher temperature periods will tend to reduce the shelf life as stated by the manufacturer for a lower room temperature. Storage temperatures should be controlled at a low value, such as is common in a refrigerator.

Likewise, the exposure to air contamination should be minimized. Therefore, whenever possible, susceptible organics should be purchased in small sealed containers that will be opened only once and discarded rather than bulk containers that are opened many times to withdraw small quantities. If small containers are not available, the air space in the container should be purged with dry nitrogen and the container tightly sealed. Or the air could be evacuated to create a vacuum of about 25 inches of mercury before the

container is sealed again. These precautions will improve the shelf life of the larger volume containers.

The increased use of pre-mixed and frozen resins has aided in minimizing the problem of temperature fluctuations and multiple exposures of resins to room temperature.